

**Amendment and Response**

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Serial No.: 10/032,357

Confirmation No.: 4965

Filed: December 21, 2001

For: METHODS FOR PLANARIZATION OF GROUP VIII METAL-CONTAINING SURFACES USING  
OXIDIZING GASES

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**Amendments to the Claims**

This listing of claims replaces all prior versions, and listings, of claims in the above-identified application:

**Listing of Claims**

1. (Cancel)
2. (Previously Presented) The method of claim 15 wherein the Group VIII metal-containing surface of the substrate comprises a Group VIII metal in elemental form or an alloy thereof.
3. (Original) The method of claim 2 wherein the Group VIII metal-containing surface comprises elemental platinum, rhodium, iridium, ruthenium, or a combination thereof.
4. (Original) The method of claim 3 wherein the Group VIII metal-containing surface comprises elemental platinum.
5. (Previously Presented) The method of claim 15 wherein the Group VIII metal is present in an amount of about 10 atomic percent or more.
6. (Previously Presented) The method of claim 15 wherein the substrate is a semiconductor substrate or substrate assembly.
7. (Currently Amended) The method of claim [[15]]30 wherein the polishing surface comprises a polishing pad and the planarization composition comprises a plurality of abrasive particles having a hardness of no greater than about 9 Mohs.

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8. **(Cancel)**
9. **(Previously Presented)** The method of claim 7 wherein the plurality of abrasive particles comprise  $\text{CeO}_2$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{SiO}_2$ , and mixtures thereof.
10. **(Previously Presented)** The method of claim 15 which is carried out in one step.
11. **(Cancel)**
12. **(Previously Presented)** The method of claim 15 wherein the oxidizing gas is selected from the group consisting of oxygen, air, and combinations thereof.
13. **(Original)** The method of claim 12 wherein the oxidizing gas is oxygen.
14. **(Previously Presented)** The method of claim 15 wherein planarizing is carried out using a fixed abrasive article.
15. **(Currently Amended)** A planarization method comprising:
  - positioning a Group VIII metal-containing surface of a substrate to interface with a polishing surface, wherein the Group VIII metal is selected from the group consisting of rhodium, iridium, ruthenium, osmium, palladium, platinum, and combinations thereof;
  - supplying an acidic planarization composition in proximity to the interface;
  - feeding an oxidizing gas into the planarization composition;
  - and

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planarizing the Group VIII metal-containing surface to selectively remove the Group VIII metal-containing surface relative to materials containing other metals at a selectivity ratio of at least 10:1;

wherein the oxidizing gas is selected from the group consisting of oxygen, air, nitrous oxide, nitric oxide, sulfur trioxide, and combinations thereof;

wherein the polishing surface comprises a fixed abrasive article or a polishing pad; and

wherein when the polishing surface comprises the polishing pad the planarization composition comprises a plurality of abrasive particles having a hardness of no greater than 9 Mohs.

16. (Currently Amended) A planarization method comprising:

positioning a Group VIII metal-containing surface of a substrate to interface with a polishing surface, wherein the Group VIII metal is selected from the group consisting of rhodium, iridium, ruthenium, osmium, palladium, platinum, and combinations thereof;

supplying an acidic planarization composition in proximity to the interface;

feeding an oxidizing gas, which is selected from the group consisting of oxygen, air, and combinations thereof, into the planarization composition;

and

planarizing the Group VIII metal-containing surface to form a substantially defect-free surface;

wherein the oxidizing gas is fed into the composition in an amount of no greater than about 10% by weight;

wherein the polishing surface comprises a fixed abrasive article or a polishing pad; and

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wherein when the polishing surface comprises the polishing pad the planarization composition comprises a plurality of abrasive particles having a hardness of no greater than 9 Mohs.

17. **(Currently Amended)** A planarization method comprising:

providing a semiconductor substrate or substrate assembly including at least one region of a platinum-containing surface;

providing a polishing surface;

providing an acidic planarization composition at an interface between the at least one region of platinum-containing surface and the polishing surface; and

feeding an oxidizing gas into the planarization composition;

planarizing the at least one region of platinum-containing surface to selectively remove the platinum-containing surface relative to BPSG or TEOS at a selectivity ratio of at least 10:1;

wherein the oxidizing gas is selected from the group consisting of oxygen, nitrous oxide, air, and combinations thereof;

wherein the polishing surface comprises a fixed abrasive article or a polishing pad; and

wherein when the polishing surface comprises the polishing pad the planarization composition comprises a plurality of abrasive particles having a hardness of no greater than 9 Mohs.

18. **(Original)** The method of claim 17 wherein the platinum is present in an amount of about 10 atomic percent or more.

19. **(Original)** The method of claim 17 wherein the platinum-containing surface comprises elemental platinum.

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20. **(Original)** The method of claim 17 wherein the planarization composition comprises a plurality of abrasive particles selected from the group consisting of  $\text{CeO}_2$ ,  $\text{Al}_2\text{O}_3$ ,  $\text{SiO}_2$ , and mixtures thereof.
21. **(Original)** The method of claim 17 wherein the platinum-containing surface comprises a platinum alloy.
22. **(Original)** The method of claim 17 wherein the semiconductor substrate or substrate assembly is a silicon wafer.
23. **(Cancel)**
24. **(Previously Presented)** The method of claim 17 wherein the oxidizing gas is selected from the group consisting of oxygen, air, and combinations thereof.
25. **(Previously Presented)** The method of claim 24 wherein the oxidizing gas is oxygen.
26. **(Currently Amended)** A planarization method for use in forming a capacitor or barrier layer:
- providing a wafer having a patterned dielectric layer formed thereon and a Group VIII metal-containing layer formed over the patterned dielectric layer, wherein the Group VIII metal is selected from the group consisting of rhodium, iridium, ruthenium, osmium, palladium, platinum, and combinations thereof;
- positioning a first portion of a polishing surface for contact with the Group VIII metal-containing layer to selectively remove the Group VIII metal-containing layer relative to materials containing other metals at a selectivity ratio of at least 10:1;

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providing an acidic planarization composition in proximity to the contact between the polishing surface and the Group VIII metal-containing layer;

feeding an oxidizing gas into the planarization composition;

and

planarizing the Group VIII metal-containing layer;

wherein the oxidizing gas is selected from the group consisting of oxygen, air, nitrous oxide, nitric oxide, sulfur trioxide, and combinations thereof;

wherein the polishing surface comprises a fixed abrasive article or a polishing pad; and

wherein when the polishing surface comprises the polishing pad the planarization composition comprises a plurality of abrasive particles having a hardness of no greater than 9 Mohs.

27. (Cancel)

28. (Cancel)

29. (Cancel)

30. (Currently Amended) A planarization method comprising:

positioning a Group VIII metal alloy-containing surface of a substrate to interface with a polishing surface, wherein the Group VIII metal is selected from the group consisting of rhodium, iridium, ruthenium, osmium, palladium, platinum, and combinations thereof;

supplying a planarization composition in proximity to the interface;

and

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planarizing the Group VIII metal-containing surface to selectively remove the Group VIII metal alloy-containing surface relative to materials containing other metals at a selectivity ratio of at least 10:1;

wherein the planarization composition comprises an oxidizing gas having a standard reduction potential of at least about 1.4 versus a standard hydrogen electrode at 25°C; and

wherein the method is carried out in one step.

31. **(Previously Presented)** The method of claim 30 wherein the Group VIII metal alloy-containing surface comprises a platinum alloy.

32. **(Currently Amended)** A planarization method comprising:

positioning a Group VIII metal alloy-containing surface of a substrate to interface with a polishing surface, wherein the Group VIII metal is selected from the group consisting of rhodium, iridium, ruthenium, osmium, palladium, platinum, and combinations thereof;

supplying a planarization composition in proximity to the interface;

and

planarizing the Group VIII metal alloy-containing surface using a fixed abrasive article to selectively remove the Group VIII metal alloy-containing surface relative to materials containing other metals at a selectivity ratio of at least 10:1;

wherein the planarization composition comprises an oxidizing gas having a standard reduction potential of at least about 1.4 versus a standard hydrogen electrode at 25°C.

33. **(Previously Presented)** The method of claim 32 wherein the Group VIII metal alloy-containing surface comprises a platinum alloy.

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34. **(Currently Amended)** A planarization method comprising:
- positioning a Group VIII metal alloy-containing surface of a substrate to interface with a polishing surface, wherein the Group VIII metal is selected from the group consisting of rhodium, iridium, ruthenium, osmium, palladium, platinum, and combinations thereof;
  - supplying a planarization composition in proximity to the interface;
  - and
  - planarizing the Group VIII metal-containing surface to selectively remove the Group VIII metal alloy-containing surface relative to materials containing other metals at a selectivity ratio of about 20:1 to about 100:1;
- wherein the planarization composition comprises an oxidizing gas selected from the group consisting of oxygen, air, nitrous oxide, nitric oxide, sulfur trioxide, and combinations thereof.
35. **(Previously Presented)** The method of claim 34 wherein the oxidizing gas is selected from the group consisting on oxygen, air, and combinations thereof.
36. **(Previously Presented)** The method of claim 35 wherein the oxidizing gas is oxygen.
37. **(Previously Presented)** The method of a claim 34 wherein the Group VIII metal alloy-containing surface comprises a platinum alloy.
38. **(Currently Amended)** A planarization method comprising:
- positioning a Group VIII metal-containing surface of a substrate to interface with a polishing surface, wherein the Group VIII metal is selected from the group consisting of rhodium, iridium, ruthenium, osmium, palladium, platinum, and combinations thereof;



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supplying a planarization composition in proximity to the interface;

and

planarizing the Group VIII metal-containing surface to selectively remove the Group VIII metal-containing surface relative to materials containing other metals at a selectivity ratio of at least 10:1;

wherein the planarization composition comprises an oxidizing gas selected from the group consisting of oxygen, air, nitrous oxide, nitric oxide, sulfur trioxide, and combinations thereof; and

wherein the planarization composition comprises a plurality of abrasive particles having a hardness of no greater than 9 Mohs.

39. **(Previously Presented)** The method of claim 38 wherein the oxidizing gas is selected from the group consisting of oxygen, air, and combinations thereof.

40. **(Previously Presented)** The method of claim 39 wherein the oxidizing gas is oxygen.

41. **(Currently Amended)** A planarization method comprising:

positioning a Group VIII metal-containing surface of a substrate to interface with a polishing surface, wherein the Group VIII metal is selected from the group consisting of rhodium, iridium, ruthenium, osmium, palladium, platinum, and combinations thereof;

supplying a planarization composition in proximity to the interface;

and

planarizing the Group VIII metal-containing surface using a fixed abrasive article to selectively remove the Group VIII metal-containing surface relative to materials containing other metals at a selectivity ratio of at least 10:1;

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wherein the planarization composition comprises an oxidizing gas selected from the group consisting of oxygen, air, nitrous oxide, nitric oxide, sulfur trioxide, and combinations thereof.

42. **(Previously Presented)** The method of claim 41 wherein the oxidizing gas is selected from the group consisting of oxygen, air, and combinations thereof.
43. **(Previously Presented)** The method of claim 42 wherein the oxidizing gas is oxygen.